

REPORTS on the MARINE BIOLOGY of the SUDANESE RED SEA.—VIII. The ALCYONARIANS. By Prof. J. ARTHUR THOMSON, M.A., and Mr. JAMES M. MCQUEEN, M.A., B.Sc., University of Aberdeen. (Communicated by Professor HERDMAN, D.Sc., F.R.S., President.)

(PLATES 5-8 and 4 Text-figures.)

[Read 5th December, 1907.]

THIS collection of Alcyonarians was made in 1906 by Mr. Cyril Crossland, M.A., B.Sc., on and off the shores of the Red Sea, in the course of his investigation of the Sudanese marine fauna. The localities where he collected were:—Suakim, Khor Dongola, Mersa Makdah, Shubuk, Matala, Etuleh, Wadi Lehama, Kal el Kebira, Shab Baya, Rawaya, and Agig. The indefatigable collector has furnished us with a few notes as to the colour of some of the living animals.

The collection includes the following 26 species:—

I. STOLONIFERA.

*Clavularia pulchra*, Thomson and Henderson.

*Sympodium fulvum* (Forskål).

*Tubipora purpurea*, Pallas.

II. ALCYONACEA.

*Xenia umbellata*, Lamarck.

„ *cærulea*, Ehrenberg.

„ *fuscescens*, Ehrenberg.

*Alcyonium sphaerophorum* (Ehrenberg).

*Sarcophytum glaucum*, Quoy et Gaimard.

*Sclerophytum gardineri*, Pratt.

„ *querciforme*, Pratt.

„ *densum* (Whitelegge).

*Lithophytum arboreum*, Forskål.

„ *brassicum* (May).

„ *thyrsoides* (Ehrenberg).

„ *crosslandi*, n. sp.

„ *macrosciculatum*, n. sp.

*Nephtya zanzibarensis*, Thomson and Henderson.

„ *albida* (Holm).

*Spongodes hemprichi*, Klunzinger.

„ *hartmeyeri*, Kükenthal.

„ *suesiana*, n. sp.

„ *pharonis*, n. sp.

III. PSEUDAXONIA.

*Melitodes coccinea* (Ellis).

„ *splendens*, n. sp.

*Clathraria rubrinodis*, Gray.

„ *acuta*, Gray.

Order I. **STOLONIFERA**, Hickson.

*CLAVULARIA PULCHRA*, Thomson and Henderson (1906).

See J. Arthur Thomson and W. D. Henderson: "Alcyonaria of Zanzibar and British East Africa from Collections made by Cyril Crossland," Proc. Zool. Soc. 1906, p. 405.

A large colony growing on a pearl-oyster shell and on the stone to which the shell is attached.

The polyps, which arise from a strong basal membrane, are large and substantial; the body varies from 10 to 30 mm. in length, and from 2 to 3.5 mm. in breadth; the tentacles are 5 to 10 mm. in length. There is a very marked hypostome, about 1 mm. high. There are 28 pinnules on each side of a tentacle, and they are for the most part very long and slender. In some cases, however, they are almost wart-like. This diversity depends in this case on the degree of contraction.

The whole surface of the colony glistens with calcareous rods; the following measurements were taken of their length and breadth in millimetres:— $0.054 \times 0.018$ ;  $0.09 \times 0.02$ .

*Locality*.—Khor Dongola, 10 fathoms; previously recorded from Zanzibar shore.

*SYMPODIUM FULVUM* (*Forskål*).

= *Lithophyton fulvum*, Forskål (1775).

*Symphodium fulvum*, Ehrenberg (1884).

See W. May: "Beiträge zur Systematik und Chorologie der Alcyonaceen," Jenaische Zeitschr. Naturwiss. xxxiii. (1899) p. 52.

W. Kükenthal: "Ueber einige Korallenthiere des roten Meeres," Festschrift von E. Haeckel, 1904, p. 41.

A large number of specimens seem to be referable to this species, the only noteworthy difference from the type being that the general spicules of the coenenchyma are not visible to the naked eye. A characteristic feature is the armature of the polyp-body, which consists of eight double rows of spicules arranged in chevron, and with some horizontally disposed spicules at the bases of the rows. According to Kükenthal, this type should be referred to *Alcyonium*.

*Locality*.—Very abundant about Matala Island in Khor Dongola, one of the richest pearling shallows. Previously recorded from the Red Sea and East Africa (Tumbatu).

*TUBIPORA PURPUREA*, Pallas.

The differences between alleged different species of *Tubipora* remain in a very unsatisfactory stage of definition. Emphasis has been laid, for instance, on the number of pinnule-rows. But our specimen shows with equal clearness polypes whose tentacles have a single row on each side, and polyps whose tentacles have a double row on each side. The difference is in this case due

to the different degrees of contraction, and is therefore of no significance. We have referred the specimen to Pallas's species, *T. purpurea*. From this it does not seem to us that *T. chamissonis* can be separated.

Many of the polyps are crowded with spherical or nearly spherical reproductive bodies, most of which show an internal cavity and a wall with several layers of nuclei. The following measurements of diameters were taken in millimetres :  $0.0765 \times 0.0765$  ;  $0.136 \times 0.1445$  ;  $0.296 \times 0.296$  ;  $0.323 \times 0.323$  ;  $0.34 \times 0.351$ . These will form the subject of subsequent study, along with other bodies of a similar nature which occur in various Alcyonarians. They are either young embryos or sperm-sacs.

*Locality*.—Outer edge of the reef (Shubuk). Previously recorded from the Red Sea, from Zanzibar (as *T. chamissonis*), and from East Indies (as *T. chamissonis*).

## Order II. **ALCYONACEA**, Verrill.

### *XENIA UMBELLATA*, Lamarck.

Numerous colonies with whitish-brown stems and chocolate-brown polyps. Many of the groups are 50 mm. in height, the stem being about 30 mm., and the polyp-bearing region about 20 mm. A common size of polyp is 10–12 mm., the tentacles and the polyp-body being each 5–6 mm. in length. The polyp-bodies and tentacles are thickly covered with glistening calcareous corpuscles. These are arranged in 8 very distinct longitudinal rows on the polyp-body. Every here and there one observes what looks with low power like a perforation about a millimetre in diameter and with a perfectly regular contour. These pore-like spots are dense colonies of zoochlorellæ. There are on each side of the tentacles four rows of long pinnules, about 18–20 in each row. There are abundant ova.

While the description just given applies to a large number of colonies, there are many others which differ markedly, *e. g.* in being much smaller, in showing no spicules or almost none, in having some reddish colour, in the number of rows of pinnules, in the total number of pinnules, and in the length of the pinnules. After a careful examination of a large number of specimens, we have come to the conclusion that these are all referable to a very variable species.

A specimen from the outer part of Suakim Harbour has a peculiar reddish colour, which Mr. Crossland noted as "not natural"; but it may be recalled that Klunzinger observed a rusty brown on the inner side of the tentacles. In this specimen the body of the polyp is about 10 mm. in length; the tentacles are about 8 mm. in length; there are slender, elongated, pointed pinnules in 2–3 rows about 12 in each row. There are very abundant zoochlorellæ, and there is not the slightest trace of effervescence when the polyp is dropped into dilute hydrochloric acid.

In the living colonies there was considerable difference in coloration :— (a) whitish stems, bluish tentacles, grey pinnules ; (b) whitish-brown stems, chocolate-brown polyps ; (c) whitish zooids, chocolate-brown tentacles.

Some of the colonies which seem referable to this variable species show only two rows of pinnules on each side of the tentacles, and greatly elongated tentacles appear as if they only had one row. It was easy to find tentacles with three rows of 20 pinnules, or two rows of 30 pinnules. This matter of rows of pinnules is a very untrustworthy and useless character. Young polyps occur at the bases of those fully-formed, and show various stages from minute zooid-like buds on which no tentacles are visible with low power, to small forms with distinct tentacles and pinnules, but only about a tenth the size of the ordinary polyps. Over and over again we have thought for a time that we had to do with a clear case of dimorphism of zooids, but further examination has shown that there were transitions between minute polyps showing *no* tentacles and others not much larger which exhibited them. Moreover, in colonies apparently identical in every other respect with those showing minute zooids without tentacles, no such zooids could be found.

*Localities.*—Various parts of Suakim Harbour, 1–2 fathoms. Previously recorded from Red Sea, Mozambique, Tumbatu, Zanzibar, Ceylon, Pacific Ocean (New Britain).

#### *XENIA CÆRULEA, Ehrenberg.*

A small specimen growing on a coral fragment presents some difficulty. The polyps are about 3·5 mm. in height, the tentacles are about the same. On each side of the tentacle there are 16–20 pinnules, in 2–3 rows or in one. The two lowest pinnules are small, but it cannot be said that there are two kinds of pinnules. The extended pinnules are elongated, slender, and pointed.

The tentacles and the bodies of the polyps show large numbers of zoochlorellæ. In some cases the colour remained bright green. Under low power the surface had a glistening appearance, as if dusted with refractive particles. These are zoochlorellæ, not spicules. The calcareous corpuscles are very minute and by no means abundant. The specimen may be referred to Ehrenberg's *X. cærulea*, or, what comes almost to the same thing, it may be regarded as a dwarf variety of *X. umbellata* \*. In another specimen the number of pinnules on each side was 24 in two rows, the whole surface glistened with zoochlorellæ, and no effervescence was seen when the polyp was placed in dilute acid.

*Locality.*—Off S.E. corner of Shubuk, 9 fathoms ; bottom of coarse sand, shells, and coral. Etuleh shoals in Suez Bay.

\* It seems certain that *X. umbellata*, Lamarck, *X. fuscescens*, Ehrenberg, and *X. cærulea* Ehrenberg, are very closely related. It may be necessary eventually to unite them in one variable species.

*XENIA FUSCESCENS*, Ehrenberg.

Several colonies, showing two sizes of zooids, are referable to this species, which is closely related to *X. umbellata*, Savigny.

The larger zooids have bodies up to 18 mm. in length, with tentacles about half as long. There are about 40 long slender pinnules on each side, in two rows. There are abundant zoochlorellæ.

The small zooids are 2-4 mm. in height. They show minute tentacles, but no pinnules.

*Locality*.—Suakim Harbour,  $\frac{1}{2}$  fathom. Previously recorded from the Red Sea, Zanzibar.

*ALCYONIUM SPHÆROPHORUM* (Ehrenberg).

See C. B. Klunzinger: Die Korallthiere des rothen Meeres, Part I. Die Alcyonarien, etc., 1877, p. 22.

W. May, 1899, *loc. cit.* p. 105.

The collection includes numerous specimens of this common species. In their mode of growth they more nearly resemble *A. pachyclados*, but their spicules are nearest those of *A. sphærophorum*. We see no reason for regarding these as distinct species, and we would suggest the incorporation of the former in the latter.

We are inclined to think that *A. globuliferum*, Klunzinger, *A. digitulatum*, Klunzinger, and *A. brachyclados*, Ehrenberg, should be referred, along with *A. pachyclados*, to one species—*A. sphærophorum*. As described and figured, they do not seem to us to differ in more than slight quantitative characters, which are probably not more than individual fluctuations. The specimens here referred to *A. sphærophorum* furnish all the kinds of spicules figured as distinctive of *A. globuliferum*, *A. digitulatum*, and *A. brachyclados*, though the most prevalent agree with those figured as distinctive of *A. sphærophorum*. The colour of the living specimens was "like weak cocoa" with "chocolate" tentacles. This corresponds with Ehrenberg's "polypis fuscis."

Twelve species of *Alcyonium* have been reported from the Red Sea; but there is no doubt that the list will have to be much reduced.

*Locality*.—From the coral shoal of Kal el Kebira in Suez Bay. Previously recorded from Red Sea, Madagascar.

*SARCOPHYTUM GLAUCUM*, Quoy et Gaimard. (Plate 5. fig. 5.)

See E. von Marenzeller: "Ueber die *Sarcophytum* benannten Alcyoniiden," Zool. Jahrb. i. (1886) p. 352, Taf. ix. figs. 1 & 2.

The collection includes several specimens of this species.

A typical colony consists of a stout trunk, 1.5 cm. high by 4.7 cm. broad, somewhat concealed by the overhanging much folded lobes of the capitulum. The upper surface of the capitulum is about 11.5 cm. in breadth, and the appearance presented by the convoluted and dovetailed lobes has been compared to that of a Meandrine Coral.

The autozooids are large and well-marked. Towards the periphery of the capitulum they are closely aggregated in rows parallel to the free border, the individuals of adjacent rows alternating. Towards the centre of the capitulum they become sparser. A converse distribution of the siphonozooids is to be noted.

Towards the centre the siphonozooids are very numerous; as many as 6 to 13 can be counted in a straight line between two adjacent autozooids; peripherally only 1 to 3.

The spicules agree with Marenzeller's figures.

The following measurements were taken of length and breadth in millimetres:—

Cortical spicules from the lobes of the capitulum:

Clubs:  $0.22 \times 0.06$ ;  $0.175 \times 0.025$ ;  $0.15 \times 0.025$ ;  $0.13 \times 0.04$ ;  $0.1 \times 0.015$ .

Rods:  $0.35 \times 0.025$ ;  $0.29 \times 0.025$ ;  $0.26 \times 0.02$ ;  $0.21 \times 0.025$ ;  $0.15 \times 0.015$ .

Spindles:  $0.27 \times 0.03$ ;  $0.52 \times 0.03$ ;  $0.22 \times 0.04$ ;  $0.17 \times 0.02$ ;  $0.15 \times 0.02$ ;  $0.075 \times 0.02$ .

Spicules from the autozooids:

Rods:  $0.28 \times 0.02$ ;  $0.27 \times 0.02$ ;  $0.26 \times 0.02$ ;  $0.25 \times 0.02$ ;  $0.21 \times 0.01$ .

Cortical spicules from the trunk:

Tuberculate spindles:  $0.8 \times 0.15$ ;  $0.8 \times 0.12$ ;  $0.78 \times 0.16$ ;  $0.74 \times 0.12$ ;  $0.68 \times 0.14$ ;  $0.62 \times 0.12$ ;  $0.55 \times 0.15$ ;  $0.5 \times 0.1$ ;  $0.47 \times 0.075$ ;  $0.44 \times 0.06$ ;  $0.45 \times 0.075$ ;  $0.35 \times 0.075$ .

Slightly spinose spindles:  $0.39 \times 0.04$ ;  $0.34 \times 0.04$ ;  $0.32 \times 0.04$ ;  $0.3 \times 0.06$ ;  $0.15 \times 0.03$ .

Clubs:  $0.24 \times 0.06$ ;  $0.2 \times 0.05$ ;  $0.18 \times 0.05$ ;  $0.15 \times 0.03$ ;  $0.12 \times 0.05$ ;  $0.1 \times 0.04$ .

Smooth spindles:  $0.4 \times 0.04$ ;  $0.275 \times 0.03$ ;  $0.23 \times 0.03$ ;  $0.22 \times 0.02$ ;  $0.12 \times 0.04$ .

The colour in spirit is light to medium brown. Mr. Crossland notes that the colour of the living colonies was greenish brown, but that the tentacles were white in some. Consequently the fully expanded colony, seen from above, often appeared white.

*Locality*.—Suakim Harbour; growing in proximity to coral, Sherm Shekh. Previously recorded from Australia, Red Sea, Tonga Island, Viti Island, Maldivé Islands.

#### SCLEROPHYTUM GARDINERI, *Pratt*.

See E. M. Pratt: "The Alcyonaria of the Maldives," in Gardiner, Fauna and Geography of the Maldivé and Laccadive Archipelagoes, ii. (1903) p. 527.

Several specimens belonging to this species illustrate how a colony becomes gradually more complex in its structure with increased growth. A young colony is represented by an elliptical mass 7.5 cm. by 5.5 cm.; from its

upper surface lobes arise to a height varying from 0.5 mm. to 7 mm. The smaller lobes are wart-like. An older colony, shaped like a half-moon, carries on its convex upper surface several lobes, the largest attaining a height of 2 cm. ; these lobes have numerous digitate branches up to 7 mm. in length with a breadth of about 4 mm.

The spicules agree closely with the description given by Miss Pratt (*Alcyonaria* of the Maldives, p. 527), and consist of clubs which average 0.06 to 0.1 mm. in length by 0.02 to 0.06 mm. in breadth, and spindles 0.16 to 0.2 mm. in length by 0.06 mm. in breadth.

The tuberculate spicules are about 3 mm. long and 0.8 to 1 mm. broad.

The colour of a colony in spirit is light to dark brown ; during life it was dull chocolate.

*Locality*.—Very abundant locally in reef gaps due south of Shubuk. Previously recorded from the Maldives.

*SCLEROPHYTUM QUERCIFORME*, Pratt. (Plate 8. fig. 1.)

See E. M. Pratt, 1903, *loc. cit.* p. 530.

Several fine colonies of this species are included in the collection. The specimen photographed (Pl. 8. fig. 1) has a short wrinkled and furrowed trunk, somewhat compressed laterally.

The branches come off rather abruptly from the stem and pass almost imperceptibly into a much branched capitulum.

As the photograph suggests, the colonies tend to be more complex than Miss Pratt's figure (*Alcyonaria* of the Maldives, pl. xxxi. fig. 33) would lead one to suppose.

The spicules of the capitulum are very various, comprising tuberculate spindles similar to those of the trunk though smaller, spinose spindles and clubs.

The following measurements were taken of length and breadth in millimetres :—

Spinose spindles : 0.32 × 0.03 ; 0.28 × 0.03 ; 0.25 × 0.03 ; 0.18 × 0.02.

Clubs : 0.23 × 0.02 ; 0.22 × 0.03 ; 0.2 × 0.04 ; 0.18 × 0.02 ; 0.015 × 0.04 ;  
0.14 × 0.04 ; 0.12 × 0.03 ; 0.08 × 0.03.

The spicules of the trunk are tuberculate spindles, rarely forked, besides clubs and spinose spindles. The tuberculate spicules vary greatly in size, the largest being about 5 mm. by 0.7 mm.

The following are the measurements of the colony represented in the photograph :—Breadth of trunk at base, 3.5 cm. ; breadth of capitulum, 8.5 cm. ; height of capitulum, 4.5 cm.

The colour of the colony in spirit is light to dark brown ; when alive it was purple-slate.

*Locality*.—Off south-east corner of Shubuk, at a depth of 9 fathoms, on a bottom of coarse sand, shells, and coral. Previously recorded from the Maldives.

SCLEROPHYTUM DENSUM (*Whitelegge*).

= *Lobophytum densum*, Whitelegge.

See Th. Whitelegge, "The Alcyonaria of Funafuti," Mem. Australian Mus. 1897, p. 219, pl. xi. figs. 4 a-4 h.

See E. M. Pratt, 1903, *loc. cit.* p. 521, pl. xxix. fig. 18, pl. xxx. figs. 20-22.

This species is represented by two very hard and brittle colonies. The trunk of one colony is 7.5 cm. broad and 5.8 cm. high. It passes almost imperceptibly into numerous finger-like processes. What we have observed in these specimens corresponds closely with Miss Pratt's figures (Alcyonaria of the Maldives, 1903).

Whitelegge (1897) has classified the spicules very minutely, and his subdivisions have been followed in taking the following measurements of length and breadth in millimetres :—

- i. Large fusiform, with simple spine-like tubercles and usually with a transverse median constriction :  $2.5 \times 0.5$  ;  $2.1 \times 0.4$  ;  $2 \times 0.4$ .
- ii. Large fusiform, subcylindrical or subclavate, closely tuberculate, the tubercles being thickly studded with minute spiny warts :  $3.1 \times 0.5$  ;  $2.7 \times 0.5$  ;  $2.3 \times 0.45$  ;  $1.9 \times 0.4$ .
- iii. Smaller fusiform, strongly but distantly tuberculate :  $0.75 \times 0.25$  ;  $0.6 \times 0.2$ .
- iv. Small fusiform, comparatively smooth, but with some spines :  $1 \times 0.18$  ;  $0.48 \times 0.1$ .
- v. Spindles :  $0.22 \times 0.04$  ;  $0.19 \times 0.04$  ;  $0.17 \times 0.03$  ;  $0.06 \times 0.03$ .
- vi. Clubs :  $0.12 \times 0.04$  ;  $0.08 \times 0.04$ .

The colour of the colony in spirit is pale yellow ; when living it was bluish-grey.

*Locality*.—Forms great sheets in about four feet of water in Suakim Archipelago (Tella Tella Seghir Island). Previously recorded from Funafuti, China Seas, British New Guinea, the Maldives.

LITHOPHYTUM ARBOREUM, *Forskål*.

For descriptions, see W. May (1899), *loc. cit.* p. 134, and W. Kükenthal, "Versuch einer Revision der Alcyonarien. II. Die Nephthyiden, 1 Teil," Zool. Jahrb. 1903, p. 124.

A large number of specimens are referable to this species. There is considerable variety as regards the dimensions of the spicules, and some forms approach *L. stuhlmanni*.

One of the largest specimens consists of a common basis 7 cm. in breadth, from which six branches take origin. These bear secondary branches on



which the polyps are thickly clustered in catkins. A typical branch separated from the common basis corresponds closely to the figure given by Klunzinger (1877).

In more than one specimen we found no trace of spicules, but as these specimens were badly preserved we suppose that some acid had been accidentally added to the preservative.

*Localities.*—Suez; Coral shoal of Kal el Kebira in Suez Bay; Khor Abu Hamama, 10 fathoms, muddy bottom. Previously recorded from Red Sea, Zanzibar, New Britain.

LITHOPHYTUM BRASSICUM (*May*). (Plate 5. fig. 4.)

See W. May, 1899, *loc. cit.* p. 139, fig. 22. W. Kükenthal, 1903, p. 120.

We have figured (Pl. 5. fig. 4) a specimen which agrees in essential features with *Lithophytum brassicum*, though it is somewhat divergent in its mode of growth and general appearance. It is fixed to a piece of Millepore and rises to a height of 20 mm., with a maximum breadth of 55 mm. It shows about sixty subglobose heads, each bearing about a score of polyps which are deeply retracted. The colour is a dull light brown.

*Locality.*—Edge of leeward reef, Suakim Archipelago, Tella Tella Kebira. Previously recorded from Zanzibar.

LITHOPHYTUM THYRSOIDES (*Ehrenberg*).

= *Ammothea thyrsoides*, Ehrenberg.

See W. Kükenthal, 1903, *loc. cit.* p. 109.

Several fine specimens of this common species are included in the collection. They consist of a common basis from which cylindrical stalks rise parallel to one another. The polyps arise directly from the ends of the stalks. The spicules of the stalks and polyps are very slender transparent spindles with few warts.

The following measurements were taken of length and breadth in millimetres :—

- (a) Polyp-spicules :  $0.3 \times 0.01$  ;  $0.28 \times 0.01$  ;  $0.2 \times 0.01$  ;  $0.15 \times 0.01$  ;  
 $0.12 \times 0.01$  ;  $0.1 \times 0.1$  ;  $0.05 \times 0.01$ .  
 (b) Stem-spicules :  $0.46 \times 0.02$  ;  $0.37 \times 0.02$  ;  $0.35 \times 0.02$  ;  $0.27 \times 0.02$  ;  
 $0.2 \times 0.01$ .

The colour of the preserved specimens is yellowish-brown ; in life they were dull brown.

*Locality.*—Outer Park of Suakim Harbour. Previously recorded from Red Sea, Indian Ocean (Tumbatu), Zanzibar.

LITHOPHYTUM CROSSLANDI, n. sp.

A common stem, 2 cm. broad and 1.5 cm. high, gives origin to four limp branches showing longitudinal furrows. These branches are 13, 12, 9, and 7 cm. in length respectively, and carry secondary branches on which the

polyp-bearing twigs are clustered. The polyp-bearing twigs are in the form of catkins with a length of from 0·5 to 1·5 cm. The basal catkins are stouter and more closely beset with polyps than the upper.

A notable diagnostic feature is the presence of rows of closely aggregated small granular spicules in the tentacles, and continued on to the polyp-head and polyp-stalk.

More spicules are to be found in the cortex of the stem than in the cortex of the main branches; consequently the stem is somewhat more rigid. The spicules of the cortex include spindles with large spines; the spindles are sometimes curved, and the spines are in some cases longer on the convex surface; there are also spindles with few warts, irregular spinose bodies and bicuspid, *i. e.* with two prongs or cusps.

The following measurements were taken of length and breadth in millimetres:—

Spinose spindles : 0·72 × 0·2 ; 0·55 × 0·13 ; 0·52 × 0·1 ; 0·45 × 0·1 ;  
0·37 × 0·12 ; 0·33 × 0·15 ; 0·29 × 0·12.

Spindles with few warts : 0·42 × 0·05 ; 0·375 × 0·1 ; 0·37 × 0·1 ; 0·35 ×  
0·075 ; 0·35 × 0·1 ; 0·29 × 0·03 ; 0·25 × 0·1 ; 0·23 × 0·05.

Bicuspid : 0·47 × 0·275.

The canal walls contain highly spinose spindles, spindles with small warts, highly spinose club-shaped bodies, irregular spinose bodies, and bicuspid.

The following measurements were taken of length and breadth in millimetres:—

Highly spinose spindles (the spines being larger on the convex side) :  
0·52 × 0·12 ; 0·4 × 0·075 ; 0·37 × 0·11 ; 0·35 × 0·1 ; 0·3 × 0·1 ;  
0·3 × 0·15.

Spindles with small warts : 1·02 × 0·22 ; 0·95 × 0·2 ; 0·85 × 0·175 ;  
0·52 × 0·12 ; 0·32 × 0·1.

Highly spinose club-shaped bodies : 0·32 × 0·15 ; 0·275 × 0·175.

Bicuspid : 0·42 × 0·175.

Mr. Crossland notes that the specimen appeared whitish under water, pale brown when brought up.

*Locality*.—From a depth of three or four feet in the Coral-reef of Khor Delaweb.

#### LITHOPHYTUM MACROSPICULATUM, n. sp. (Plate 8. figs. 2 & 3.)

From a stem rather less than 1 cm. high, with a breadth of 2·5 cm., three primary branches take origin. One of these, after a course of half a centimetre, divides dichotomously into two branches of 4 and 5 cm. in length respectively. The other primary branches are 6 and 4 cm. in length.

Polyps are not borne either on the main stem or on the main branches, but

on secondary branches and the twigs which spring from these. The secondary branches are crowded closely on the primary and form catkins 1.5 to 2.5 cm. in length, the larger catkins being of a compound character.

In the cortex of the terminal polyp-bearing branches there is a longitudinal arrangement of the spindle-shaped spicules, and this is continued on to the dorsal surface of each polyp-stalk.

The polyp-heads are bent sharply on the polyp-stalks, so that the tentacular surface faces the cortex of the terminal twigs.

The cortical spicules of the stem and main branches form by interlacing a continuous armature. These spicules are of very diverse and distinctive forms, including the following :—

- (a) Boat-shaped spindles with few warts.
- (b) Curved spindles with long spines, which are more developed on the convex surface.
- (c) Very spinose club-like forms.
- (d) Triradiate spinose bodies.
- (e) Irregular spinose bodies.

The following measurements were taken of length and breadth in millimetres :—

- (a) Boat-shaped spindles :  $0.8 \times 0.15$  ;  $0.75 \times 0.075$  ;  $0.67 \times 0.1$  ;  $0.62 \times 0.1$  ;  $0.5 \times 0.075$  ;  $0.45 \times 0.09$ .
- (b) Curved spindles :  $0.95 \times 0.15$  ;  $0.85 \times 0.12$  ;  $0.8 \times 0.15$  ;  $0.73 \times 0.15$  ;  $0.7 \times 0.1$  ;  $0.65 \times 0.15$  ;  $0.52 \times 0.13$  ;  $0.5 \times 0.1$ .
- (c) Club-like forms :  $0.33 \times 0.25$ .

The spicules of the polyp-head and polyp-stalk include long curved or sinuous spindles with knob-like warts which in some cases are more numerous and better developed at the tips of the spindles ; also spindles with only a few poorly developed spines.

The following measurements were taken of length and breadth in millimetres :—

- (1) Spinose spindles :  $1.5 \times 0.1$  ;  $1.15 \times 0.1$  ;  $1.1 \times 0.12$  ;  $0.6 \times 0.05$  ;  $0.4 \times 0.05$  ;  $0.2 \times 0.02$ .
- (2) Smooth spindles with only a few spines :  $1.2 \times 0.09$  ;  $0.9 \times 0.05$  ;  $0.69 \times 0.05$ .

The spicules of the canal walls consist of spindles similar to those of the cortex, but the form with few spines predominates.

The following measurements were taken of length and breadth in millimetres :—

- (1) Spinose spindles :  $0.87 \times 0.12$  ;  $0.85 \times 0.12$  ;  $0.83 \times 0.12$  ;  $0.6 \times 0.1$  ;  $0.55 \times 0.13$  ;  $0.5 \times 0.1$ .

- (2) Smooth spindles with only a few spines:  $1.02 \times 0.15$ ;  $0.72 \times 0.15$ ;  $0.6 \times 0.075$ ;  $0.55 \times 0.075$ ;  $0.42 \times 0.1$ ;  $0.4 \times 0.05$ ;  $0.275 \times 0.04$ ;  $0.2 \times 0.05$ .

The colour of the colony in spirit is light yellow.

*Locality*.—Khor Dongola.

*NEPHTHYA ZANZIBARENSIS*, Thomson and Henderson.

See Thomson and Henderson, 1906, *loc. cit.* p. 421, pl. xxvii. fig. 3.

A specimen which seems to be referable to this species differs from the type in being distinctly more rigid; that is to say, more densely filled with spicules.

*Locality*.—Engineer Island, Khor Dongola. Previously recorded from Wasin Channel, Zanzibar.

*NEPHTHYA ALBIDA* (Holm).

= *Spongodes albida*, Holm.

See O. Holm: "Beiträge zur Kenntniss der Alcyoniden-Gattung *Spongodes*," Zool. Jahrb. viii. (1895) p. 30, 3 figs.

See Kükenthal, 1903, *loc. cit.* p. 160.

A specimen which seems referable to this species differs from the type in having the polyp-body covered with very numerous small spicules without definite arrangement in double rows. In other words, the larger polyp-spicules arranged in chevron are not represented. In including *Nephthya jagerskioldi* with *Spongodes savignyi*, Kükenthal notes the same kind of variation which we believe to have occurred here, namely a replacement of fewer larger spicules on the part of the polyp-wall by more numerous smaller spicules. This cannot be regarded as of systematic importance.

*Locality*.—Suakim Harbour. Previously recorded from the Red Sea.

*SPONGODES* \* *HEMPRICHI*, Klunzinger.

See Klunzinger, 1877, *loc. cit.*

Kükenthal, 1904, *loc. cit.*

Kükenthal: "Versuch einer Revision der Alcyonarien. II. Die Familie der Nephthyiden, 2 Teil," Zool. Jahrb. xxxi. (1905) pp. 503-726, 7 pls. & 61 figs.

Several colonies in the collection are evidently referable to a group of species which Kükenthal speaks of as closely allied, namely, *S. hartmeyeri*, *S. mayi*, *S. klunzingeri*, *S. chrenbergi*, and *S. hemprichi*.

\* According to Kükenthal, the generic name *Spongodes* should be replaced by another, and he suggests *Dendronephthya*; see page 74.

I. The specimens differ superficially from *S. hartmeyeri* :

- (1) in being much more ramified and crowded colonies ;
- (2) in the absence of any trace of foliate lower branches ;
- (3) in their colour-scheme, which is due to the thick covering of crimson spicules. As to the colour of the living specimen, Mr. Crossland notes that it appeared jet-black when seen through a fathom or two of clear water, but when brought up it showed a splendid dark crimson, shading into pink on the stem.

They differ more intimately in the following points :

- (1) The anthocodial spicules are arranged in 8 rows of 5-7 converging pairs ; they converge but slightly and are more or less longitudinal in *S. hartmeyeri*. Moreover, the uppermost spicules of the double rows do not project beyond the anthocodia as they do in *S. hartmeyeri*.
- (2) The tip of the main "Stützbündel" spicule is smooth, while in *S. hartmeyeri* the same spicule is most spinose towards the free tip.
- (3) They differ in the dimensions and direction of the spicules in the cortex of the main branches. In *S. hartmeyeri* the cortex is densely filled with large, very thick, finely spinose spindles up to  $5 \times 0.5$  mm. They seem from the drawing to be longitudinally arranged. In the specimens in this collection the spindles are for the most part arranged transversely to the long axis of the branches.

The following measurements of these spindles were taken in length and breadth in millimetres :  $2 \times 0.12$  ;  $1.8 \times 0.1$  ;  $0.65 \times 0.05$ .

II. The specimens differ superficially from *S. mayi* :

- (1) in the absence of the rigidity and brittleness characteristic of a species developed in one plane. The colonies in this collection have a well-developed bare trunk up to 7.5 cm. in length. In one specimen the stem divides somewhat dichotomously into two main divisions ; in another specimen, four main branches take origin abruptly. From the main branches secondary branches arise in every plane.
- (2) The branching is more profuse and the clusters of polyps are much denser than in *S. mayi*.
- (3) The colour-scheme is golden yellow in *S. mayi*.

They differ more intimately from *S. mayi* :

- (1) in the absence of a greatly developed projecting spicule at the end of each double row of spicules on the anthocodiæ ;

- (2) in the fact that only one “Stützbündel” spicule projects beyond the polyp-head; the tip of the “Stützbündel” spicules is *smooth*, like that of the chief “Stützbündel” spicules in *S. mayi* ;
- (3) in the disposition of the superficial cortical spicules, which are predominantly longitudinal in *S. mayi* ; and
- (4) in the character of the spicules of the cortex, which are curved spindles, while in *S. mayi* there are, in addition to spindles, clubs, four-rayed spicules, and irregular bodies.

III. The specimens differ superficially from *S. klunzingeri* :

- (1) since that species is for the most part developed in one plane with an almost suppressed trunk ;
- (2) in the mode of branching and in the disposition of the polyps in crowded bundles of 6–11 in each bundle, whereas in *S. klunzingeri* they are only 1–3 in a bundle.

They differ more intimately :

- (1) in the nature and arrangement of the anthocodial spicules, which in *S. klunzingeri* are in rows of 8–10 with the uppermost two very much longer ;
- (2) in having an entirely different “Stützbündel” made usually of two spicules ; and
- (3) inasmuch as the spicules of the canal-walls are broad and flat spinose spindles.

In the specimens the spicules of the canal-walls are varied and may be grouped as follows :

- (A) spindles of undulating contour, or halfmoon-shaped, or tending to be club-shaped ;
- (B) spindles forked at one end (bicuspid), transitional to tri-radiates ;
- (C) triradiate forms ;
- (D) irregular bodies with four arms, probably derived from C. All spinose.

IV. The colonies have a great superficial resemblance to *S. ehrenbergi*, but differ from it in having 6–11 polyps in each bundle, while *S. ehrenbergi* has 5–8.

They differ more intimately :

- (1) inasmuch as *S. ehrenbergi* has only 4–5 pairs of spicules in each double row, each about 0·3 mm. in length, the uppermost 0·5 mm. with long oblique spines ;
- (2) in the nature of the projecting spicules of the “Stützbündel,” which in *S. ehrenbergi* has a spinose tip, whereas in these specimens the tip is smooth ;

- (3) in the spicules of the cortex of the main branches, which do not include any clubs or oval spinose bodies ;
- (4) inasmuch as from the canal-walls of *S. ehrenbergi* only spindles are reported.

V. The specimens agree with *S. hemprichi* in the following respects :

- (1) There are 5-7 pairs of anthocodial spicules in each double row and the uppermost pair project very slightly. It is to be noted, however, that the number of paired spicules on the two rows on the *ventral* surface of the polyp-head may be as few as two pairs.
- (2) The projecting spicule of the "Stützbündel" has a smooth tip.
- (3) The spicules of the canal-walls are, on the whole, similar. In *S. hemprichi* there are curved spindles, triradiates, and small bodies beset with several prongs.
- (4) The spicules of the cortex are arranged transversely.
- (5) The polyp-spicules are blood-red and the polyps yellowish.

The only difference between Crossland's specimens and those described by Kükenthal lies in the general architecture, which is well represented by Kükenthal's drawing of *S. ehrenbergi*. They may be referred to the *arborescens* type of *S. hemprichi*, which Kükenthal describes as transitional between the glomerate and the divaricate mode of branching.

Another specimen which is superficially very unlike the above, but closely resembles Klünzinger's figure of *Spongodes hemprichi*, is in its details so like what we have described that we cannot but refer it to the same species, which, therefore, includes two distinct modes of growth—that figured by Klünzinger and the *arborescens* type of Kükenthal.

A case like this leads us to feel the precariousness of a classification which attaches much importance to modes of branching.

*Locality*.—Shab Baya, near Rawaya. Previously recorded from Red Sea.

#### SPONGODES HARTMEYERI, Kükenthal.

Two small rigid whitish colonies seem to be referable to this species, but differ in having no coloured spicules and in having rougher "Stützbündel" spicules. They are probably young colourless forms.

*Locality*.—Khor Dongola. Previously recorded from the Red Sea.

#### SPONGODES SUESIANA, n. sp. (Plate 5. fig. 1.)

A brownish-yellow interesting colony of apparently glomerate type. It resembles in general architecture Kükenthal's *Spongodes* (*Dendronephthya*) *clavata* (see Versuch einer Revision der Alcyonaceen, Die Nephthyiden, 2<sup>te</sup> Teil,

Taf. 26) ; but in the nature of the projecting “Stützbündel” spindle and in the number and arrangement of the spicules on the anthocodia it closely approaches *S. mayi*. It seems to belong to the group of allied species referred to under *S. hemprichi*.

There is a somewhat flattened flexible stem, longitudinally furrowed, 8.5 cm. in length and 1 cm. in breadth. The cortex of the stem shows well-marked transverse striations due to the underlying spindles.

Small polyp-bearing twigs spring from the stem, somewhat sparsely below, more thickly above, so that the apex of the stem is completely hidden by polyp-bundles.

From the stem there arise at irregular intervals secondary branches whose length decreases in a somewhat graduated fashion. The following measurements of the length of the various branches from below upwards on the stem serve to indicate this feature : 2 cm. ; 1.75 cm. ; 1.5 cm. ; 1 cm. These secondary branches bear polyp-bearing twigs in thick clusters. The polyps are in bundles of from 6 to 12 or even more.

The “Stützbündel” consists of 2 to 4 spindles, one of which projects 0.4 mm. or more beyond the anthocodia. This spindle is spinose below with a smooth tip. Of the projecting “Stützbündel” spicules, which are generally of a yellow colour, the following measurements were taken (length and breadth in millimetres) :— $2.3 \times 0.1$  ;  $2.4 \times 0.1$ . The tip is smooth for 0.35 mm.

On the anthocodia there are eight double rows of converging spicules with from 6 to 9 in each row. One spicule of the uppermost row, or occasionally both, may project for 0.2 mm. beyond the anthocodia. Thus Kükenthal’s figure of an anthocodia of *S. mayi* (see Ueber einige Korallentiere des roten Meeres, Taf. v. fig. 20) exactly represents what may be seen occasionally in this species, except that only one projecting “Stützbündel” spicule is the rule and not two as figured.

When both spicules of the uppermost row project, they lie almost parallel to each other in sharp contrast to the pairs below, which converge at a right or a slightly obtuse angle.

The tentacles are without spicules. The colour of the anthocodial spicules ranges from red to yellow.

The spicules of the upper cortex consist of spindles, clubs, bicuspid, with an occasional triradiate form. They are very spinose, not merely along the margins, but on every surface; and are colourless or tinged with yellow.

The following measurements were taken of length and breadth in millimetres :—

Spindles :  $1.7 \times 0.1$  ;  $1.4 \times 0.1$  ;  $0.95 \times 0.075$  ;  $0.8 \times 0.05$  ;  $0.75 \times 0.075$  ;  
 $0.7 \times 0.075$  ;  $0.6 \times 0.05$  ;  $0.5 \times 0.05$  ;  $0.25 \times 0.02$ .

Clubs :  $0.75 \times 0.1$  ;  $0.4 \times 0.1$ .

Bicuspid :  $0.6 \times 0.075$ .

Triradiates: each arm,  $0.3 \times 0.2$ .



The spicules of the lower cortex do not differ from those of the upper cortex in form or colour.

The following measurements were taken of length and breadth in millimetres :—

Spindles:  $0.75 \times 0.075$ ;  $0.7 \times 0.1$ ;  $0.65 \times 0.05$ ;  $0.6 \times 0.05$ ;  $0.5 \times 0.03$ ;  
 $0.4 \times 0.05$ ;  $0.3 \times 0.03$ ;  $0.1 \times 0.03$ .

Clubs:  $0.6 \times 0.1$ ;  $0.4 \times 0.1$ ;  $0.3 \times 0.1$ ;  $0.35 \times 0.075$ ;  $0.3 \times 0.075$ .

The canal-walls are without spicules.

Some other specimens agreed with the above in general structure, in the nature of the "Stützbündel," in the armature of the anthocodia, in the spicules of the cortex, and so on. Thus one could not but admit that all the colonies belonged to the same species, and yet it was impossible to say that the polyps were really grouped in bundles, which is one of the diagnostic features of the genus *Spongodes*. In some cases they were arranged on a terminal branch in a catkin-like or spike-like manner. This was the rule in one specimen.

It may be noted that Kükenthal admits that certain specimens were intermediate in this respect between *Spongodes* and *Nephthya*, and consequently difficult to place.

The point to be noted in these colonies is that, though obviously all of the same species, yet they differ in a generic feature!

If we take a composite view of all the specimens this species combines the characteristics of both *Spongodes* and *Nephthya*. Yet the colony described in detail must be placed in the glomerate division of the genus *Spongodes*. Within that division it seems to represent a new species.

*Locality*.—Suez Bay.

#### SPONGODES PHARONIS, n. sp. (Plate 5. figs. 2 & 3.)

Several colonies of the umbellate type, agreeing with Kükenthal's *rubra*-group in having branches of approximately equal length, with the upper surface practically even. They differ from any of the species of *Spongodes* hitherto described from the Red Sea—viz. : *S. saviqnyi*, *S. henprichi*, *S. klunzingeri*, *S. arborea*, *S. mayi*, *S. hartmeyer*, and *S. ehrenbergi*—in possessing the following combination of diagnostic characters :—

- a. The umbellate development of the colony.
- b. The absence of spicules on the tentacles.
- c. The absence of spicules in the canal-walls.
- d. The occasional presence of a strongly developed spine or sometimes of two spines projecting prominently beyond a corymb of polyps, greatly exceeding in diameter and in length the "Stützbündel" spicule or spicules which project beyond the anthocodia of each polyp.

The colonies show in each case a substantial trunk which at a distance of 2·5 cm. or less from its base is embraced by a collar of foliate lower branches. These leaf-like branches bear sessile polyps scattered round their margin, while further on the upper surface may be seen twigs, which divide in the corymbose fashion characteristic of the whole colony. These twigs also carry polyps on their tips.

From the angle between the rising stem and the collar spring one or two branches equal in size to those that are terminal. These branches in their turn break up into terminal corymbs. Beyond the collar, the stem after a short course divides into two or three main branches, which soon divide up into secondary branches supporting the terminal corymbs. The terminal corymbs are all brought more or less to the same level, so that the upper surface of the polyparium is somewhat flattened. A polyp-bundle usually comprises 3 to 8 individual polyps, but the number is very variable.

The polyp-head is bent more or less at a right or an acute angle to the polyp-stalk. The polyp-head is 0·8 mm. in length and 0·55 mm. in breadth. The polyp-stalk is about 1 mm. in length. The anthocodial spicules are in rows of 3 to 5 pairs, the uppermost of which do not project beyond the anthocodia.

The angle of each chevron is a very acute one, giving a somewhat longitudinal direction to the spicules of the anthocodia.

Some variation in colour is to be noted in the anthocodial spicules. In one of the colonies they are colourless, in another red, while transitional pinkish spicules are present in a third colony. In the "Stützbündel" there may be one or two projecting spicules. These spicules show very small serrations regularly disposed. Their tip may be quite smooth or with an occasional serration. Their colour varies from a light yellow to a reddish yellow.

The following measurements were taken of these spicules (length and breadth in millimetres):— $1\cdot5 \times 0\cdot03$ ;  $1\cdot25 \times 0\cdot1$ ;  $0\cdot8 \times 0\cdot03$ ;  $0\cdot7 \times 0\cdot03$ . In some of the colonies the size of the projecting "Stützbündel" spicules approaches nearer to the dimensions of the stout spines which are a feature of the terminal corymbs. These strong spines, which seem to protect and support the polyps on a terminal corymb, generally arise independently of an individual polyp, but sometimes they simply take the place of the normal but smaller "Stützbündel" spicule.

Of these stouter spindles the following measurements were taken (length and breadth in millimetres):— $4 \times 0\cdot25$ ;  $4 \times 0\cdot2$ ;  $3\cdot5 \times 0\cdot15$ ;  $3\cdot5 \times 0\cdot125$ . The tentacles are oblong with a few pinnules and without spicules.

The cortex of the upper branches contains slightly curved spindles with very fine and regularly disposed serrations.

The following measurements of these spindles were taken (length and breadth in millimetres):— $4 \times 0\cdot2$ ;  $3\cdot2 \times 0\cdot1$ ;  $1\cdot4 \times 0\cdot5$ ;  $1 \times 0\cdot03$ . Their colour in one specimen is white with a yellowish tinge, in three specimens

red, but amongst the red spindles are some with intermediate light-pink shades.

Their distinctive feature lies in the remarkably fine serration of the edges of the spindles. This is a constant feature no matter what their dimensions or colour may be.

The lower cortex contains markedly spinose irregular bodies, often somewhat star-shaped, very spinose spindles, spinose clubs, spinose triradiates, spinose bicuspids.

The following measurements were taken of length and breadth in millimetres :—

Spinose spindles :  $1 \times 0.1$  ;  $0.75 \times 0.1$  ;  $0.4 \times 0.12$  ;  $0.33 \times 0.1$  ;  $0.3 \times 0.11$  ;  
 $0.25 \times 0.1$  ;  $0.23 \times 0.075$ .

Spinose triradiates :  $0.5$  ;  $0.33$  ;  $0.3$  = length of the three arms.

Spinose bicuspids :  $0.75 \times 0.1$ .

Spinose clubs :  $0.18 \times 0.13$ .

The canal-walls in every specimen are without spicules.

The colour of the colonies in spirit varies somewhat, the colour depending on that of the spicules. Where the spicules are red, the colony is reddish ; where there are a considerable number of white or light yellow spicules, the colony is proportionately lighter in tint.

*Locality*.—From a muddy bottom, at a depth of 12 fathoms, Mersa Abu Hamama, Sudan.

### Order III. PSEUDAXONIA, G. von Koch.

MELITODES COCCINEA (*Ellis*) (= *Isis coccinea*, *Ellis*). (Plate 6. figs. 1 & 2.)

The collection includes numerous specimens which are referable to *Ellis's Isis coccinea*. From *Ellis's* figure and description there can be almost no doubt that he referred to forms like the present specimens, which must, however, be referred to the genus *Melitodes*.

The specimens are of a brilliant crimson or scarlet colour, and there is one yellow fragment. The most frequent mode of branching is that figured by *Ellis*,—a broad fan, with dichotomous branches almost all in one plane, and without anastomosis. In other specimens, however, the branches do not spread out in a broad fan, and anastomosis is frequent. The colonies stand erect, reaching a height of 4 cm. and a breadth of 2–4 cm. In some cases colonies grew so close to one another that their bases formed a continuous sheet. Solitary colonies show most clearly the typical fan-like form.

The internodes, which curve slightly in different planes, vary in length from 5–10 mm. The nodes are very short, 1–2 mm., and are not distinctly marked in the intact colonies. On the thinner twigs the verrucæ are mostly along the edges, and a somewhat flattened appearance thus results. On the

thicker branches they occur practically all over. They stand out somewhat prominently to a height of about 0.5 mm., and appear as widely open crater-like elevations or as rounded hillocks according to the state of contraction.

The whole surface of the colony is seen under the lens to be rough with spindle-shaped spicules, all of a red colour.

The spicules of the cœnenchyma are: (1) substantial tuberculate spindles, of which the following measurements were taken:— $0.3 \times 0.07$ ,  $0.27 \times 0.09$  mm. The tubercles are large and blunt. In some cases the ends of the spindles are irregularly bifid. There are also some slender curved tuberculate spindles. (2) Short compact fusiform types covered with numerous blunt tubercles:  $0.124 \times 0.05$  mm. (3) Club-shaped forms or "Stachelkeulen" with irregularly shaped tuberculate heads. From these through torch-like forms there are transitions to irregular spindles. The clubs are frequently 0.23 mm. in length by 0.1 mm. in breadth across the head. In the polyps there are minute and slender red spindles, besides a number of minute slightly tuberculate curved rodlets which are practically colourless. For both of these types a common length is 0.04 mm. The aboral surface of the tentacles bears about 5 large red spicules arranged in chevron. The axis shows longitudinal canals.

*Locality*.—From the sides of a buoy in Suez Bay, and on the coral-reef of Engineer Island, Khor Dongola.

MELITODES SPLENDENS, n. sp. (Plate 7. figs. 1 & 2.)

Numerous broken pieces of a bright orange-red Melitodid. They seem to represent several colonies. The nature of the spicules and the presence of longitudinal canals in the axis indicate the genus *Melitodes*, but we have not been able to refer the specimens to any of the numerous previously described species.

One of the pieces has a breadth of 6 mm. across an internode about 3 cm. above the base, while a node about the same height has a breadth of 9 mm. The length of the internode at this level is 11 mm., and towards the base of the colony the internodes have an average length of about 12 mm. The branching is profuse, with many anastomoses, but is mainly confined to one plane. An attempted reconstruction of the broken specimens leads one to infer that the colonies may have been about 25 cm. in height. The terminal branches are about 1 mm. in thickness.

The verrucæ are almost confined to one surface of the branches. They are somewhat scattered on the basal parts, but towards the ends their bases are in contact. They are slightly flattened hemispheres. The retracted polyp is just seen as a whitish spot on the top of the verruca.

The axis shows numerous longitudinal canals in the nodes and internodes. A thin section through a thick internode showed about ten. On the surface of the axis there is external fluting corresponding to the course of the canals in the cœnenchyma.

The spicules, which are mostly yellowish, include :—

- (a) Narrow tuberculate spindles of various sizes, *e. g.*  $0.15 \times 0.018$  mm.,  $0.108 \times 0.03$  mm.
- (b) Short broad spindles with tubercles at each end and in two whorls between, *e. g.*  $0.04 \times 0.025$  mm.
- (c) Fusiform types intermediate between (a) and (b) with sharper tubercles.
- (d) A few non-foliate clubs, *e. g.*  $0.055 \times 0.028$  mm. across the head.
- (e) Some pale yellow or almost colourless rods, sometimes almost straight and smooth, often with a median prominence on each side, often slightly curved at the ends, *e. g.*  $0.096 \times 0.012$  mm.

The generic distinctions of the Melitodidæ are not very satisfactory, but we may note that the absence of foliaceous clubs, the presence of some small nodular spicules in the cortex, and the canals in the axis point to *Melitodes*.

*Locality*.—Mersa Abu Hamama, from a muddy bottom, at a depth of 10 fathoms.

\* CLATHRARIA RUBRINODIS, *Gray*. (Plate 6. figs. 3 & 4.)

See Gray: Proc. Zool. Soc. London, 1859, p. 486; Catalogue of Lithophytes in the British Museum, 1870, p. 11, 1 fig.

= *Mopsea bicolor*, Kölliker, *Icones Histologicæ*, p. 142, 1 fig.

It is interesting to find in this collection the peculiar Melitodids to which Gray gave the names *Clathraria rubrinodis* and *C. acuta*. It is rather remarkable that such striking forms have not been more frequently collected. Apart from Gray's brief descriptions, we have found no reference to *Clathraria*.

The larger species, *C. rubrinodis*, is represented by a specimen about 12 cm. in height, which was probably the upper part of a large colony. This is suggested by the size of some of the fragments found in the same vessel.

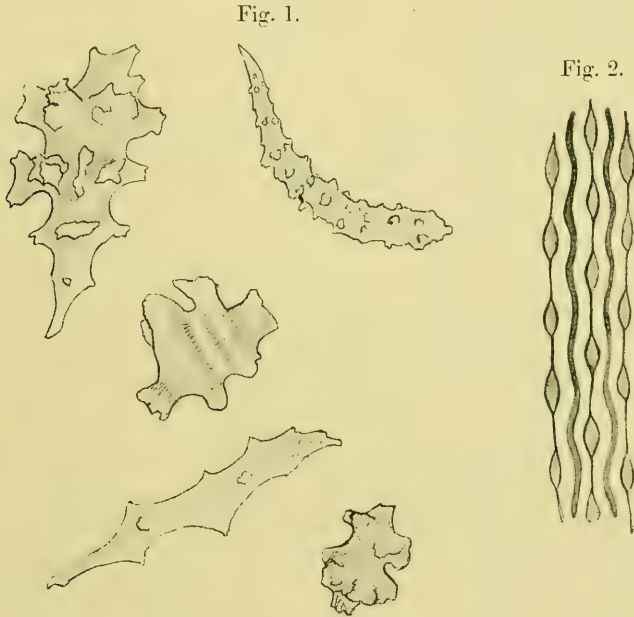
The branching is mainly in one plane, and there is abundant anastomosis. The branches arise almost invariably from the nodes. There is a strong tendency to dichotomy, and the two branches diverge at a wide angle at their common origin. This gives a very characteristic appearance, which is increased by the fact that each of the cylindrical branches is of uniform width throughout its length, and terminates bluntly, or may, indeed, be slightly thicker at the tip than at its origin. The smaller twigs show a much less marked tendency to dichotomy, and some of them narrow towards the

\* The account of *Clathraria rubrinodis* and *C. acuta* was prepared by Miss Doris L. Mackinnon as part of a thesis for the degree of B.Sc. in the University of Aberdeen.

end, which is always truncate. The stouter branches have a diameter of 4 mm. ; the more slender twigs of 2 mm.

The preserved specimens have a dirty cream-colour, frequently tinged with pale sulphur-yellow along one side of a branch and near the tips of the twigs. In the living specimens the colour was bright light yellow, with dull red joints. The specific name *rubrinodis* has reference to the dark-red horny nodes, which shine indistinctly through the whitish cœnenchyma, or appear as bright red patches where a branch has been broken away.

The internodes are of very unequal lengths, varying from 7 to 32 mm. ; the calcareous axis, stripped of cœnenchyma, has a diameter of 1-3 mm., and is white with a tinge of sulphur-yellow here and there. The longer branches may have as many as seven internodes ; the shorter branches and the twigs consist of only one piece.



*Clathraria rubrinodis*, Gray.

Fig. 1. Spicules. Fig. 2. Details of calcareous joints.

On the surface of the white calcareous axis there is a characteristic sculpturing due to longitudinal furrows. There are two sets of these furrows which alternate with one another. One set is deeper than the other and of equal width throughout. The shallower furrows are constricted at regular intervals, and the broad portions of one shallow furrow lie between the constrictions of the similar furrow on either side. In these broad ovals the polyps appear to be set.

There are no nutritive canals in the axis. A longitudinal section shows that the axis is built up of minute spindle-shaped spicules, fused together, and arranged with their long axes in the line of the long axis of the branch.

The nodes are much shorter than the internodes (3–4 mm.) and are somewhat thicker. They are composed of a dark-red horny substance, which, under the microscope, appears as a yellowish network with numerous red spindle-shaped spicules in the meshes.

It occasionally happens that a branch arises from an *internode*; in such cases the first joint is horny.

The cream-coloured cœnenchyma is crowded with small spicules. Most of these are white, but some are tinged with yellow or yellowish green. Spiny clubs and more warty double-clubs and dumb-bells are very abundant. Spindles bearing numerous very minute warts are less common, and simple spindles are rare.

The following measurements were taken of length and breadth in millimetres:—

Clubs :  $0.136 \times 0.084$ ;  $0.153 \times 0.059$ ;  $0.119 \times 0.051$ .

Double clubs :  $0.042 \times 0.034$ ;  $0.067 \times 0.055$ ;  $0.051 \times 0.042$ .

Spindles :  $0.187 \times 0.051$ ;  $0.119 \times 0.025$ .

Red spindles of nodes :  $0.102 \times 0.017$ ;  $0.085 \times 0.017$ ;  $0.068 \times 0.002$ .

The small polyps are spirally arranged almost uniformly all round the branches. They are nearly all retracted, lying almost flush with the surface of the cœnenchyma. Besides the substantial anastomosis, there may be a more superficial fusion of cœnenchyma when one branch lies against another.

*Locality*.—Coral-reef, Mersa Makdah, Shubuk.

#### CLATHRARIA ACUTA, *Gray*. (Plate 7. figs. 3 & 4.)

See *Gray*: Catalogue of the Lithophytes in the British Museum, 1870, p. 12.

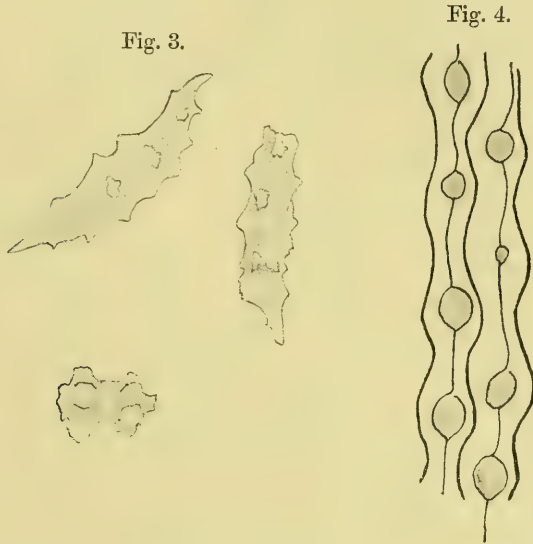
This species is represented by two specimens, one of 7 cm. and the other of 5 cm. in height. The mode of growth is tree-like and graceful. The branches, much more slender than in *C. rubrinodis*, are cylindrical and of very uniform width until close to their end, when they narrow abruptly into a sharp apex.

In the larger specimen there is a main stem, which gives off two long branches on one side, two long and three short on the other, and then bifurcates at the top. The side branches also show dichotomy. Of the seven branches four arise from the internodes. The other specimen is branched dichotomously throughout and the branches arise from the nodes. On the whole the branching is in one plane. There may be fusion of branches, but not nearly to the same extent as in *C. rubrinodis*.

The colour of the preserved specimens is a delicate flesh-pink, marked by

darker red patches where the nodes shine through the semi-transparent cœnenchyma. The living colonies were pink.

The calcareous internodes vary from 10 mm. to 17 mm. in length, and are about 2 mm. in diameter. They are marked longitudinally by sinuous furrows which expand at intervals into little round pits. The colour of the axis shades from deep rose-red to pink.



*Clathraria acuta*, Gray.

Fig. 3. Spicules. Fig. 4. Details and ornament on calcareous joints.

Microscopic examination shows that the axis is composed of numerous spindles fused together, with their long axes in line with the long axis of the branch. The nodes are dark red, much shorter than the internodes, and slightly swollen; they are composed of a yellowish horny network enclosing short red spindles.

The pinkish-white cœnenchyma is semi-transparent and very delicate. The polyps are not nearly so numerous as in *C. rubrinodis*, but are larger in proportion and project from the surface as minute warts. They seem to correspond in position to the cup-shaped pits in the axis of the internodes, and their arrangement is very markedly spiral.

The spicules of the cœnenchyma are spiny and tuberculate clubs and warty double-clubs with a few spindles and boomerangs. They are, on the whole, rather smaller than in *C. rubrinodis* and distinctly less spiny. The majority are colourless, but many show a red or pink tinge.

*Locality.*—Khor Dor.gola, near the group of Islets; rock bottom, 9½ fathoms.



*Note on the Genus Clathraria, Gray.*

In 1859 Gray gave a brief description of his genus *Clathraria* as represented by *C. rubrinodis*. In 1870 he referred the genus to the family Mopselladæ and distinguished another species, *C. acuta*.

Gray's diagnosis of *Clathraria* is as follows:—"Coral shrub-like; branches cylindrical, erect, tortuous, interosculating, of nearly equal thickness; branchlets, some free, blunt. Bark thin, granular. Cells small, immersed, nearly equally scattered on all sides of the branches; buds and branches from the swollen joints; joints elongate, white, longitudinally striated; internodes red, spongy."

Gray identified his *C. rubrinodis* with Kölliker's *Mopsea bicolor* ('Icones Histologicae,' p. 142). Kölliker defined his genus *Mopsea* thus:—"Axis without nutritive canals. Spicules generally as in *Melithæa*, but without the beautiful foliaceous clubs. Length of the clubs 0·12-0·25 mm.; length of the larger polyp-spindles 0·18-0·34 mm." Of *M. bicolor* he says:—"Soft joints red, hard joints white with green centre. Cœnenchyma white to sulphur-yellow, with uneven surface. Thickness of axis 4-7 mm."

In the 'Challenger' Report (1899) Wright and Studer separate *Clathraria* from *Mopsea*, and give the following definition:—"Cylindrical manifoldly curving branches often anastomosing, and of uniform thickness throughout. The polyps are sunk in the cœnenchyma. The axis includes no nutritive canals. Spicules in cortex, broad and short foliaceous clubs."

In subsequent literature we find no further mention of *Clathraria*, though it is a very conspicuous and characteristic type. It is so unlike other Melitodids that its retention as a distinct genus seems desirable.

The specimens from the Red Sea are clearly referable to *Clathraria* and to the species *C. rubrinodis* and *C. acuta*. We are thus able to give the habitats of these two forms, which Gray was unable to do. The note in the 'Challenger' Report that the spicules are "broad and short foliaceous clubs" must have crept in by some mistake.

The definitions which Gray gave of *Clathraria* and *Mopsea* hardly justified him in his wide separation of the two genera, which he referred to different families. He makes no mention of the form of the spicules, and he says that the branches arise in both from the soft joints.

Kölliker's *Mopsea* is separated from his *Melithæa* by having no foliaceous clubs. His definition of *Mopsea*, so far as it goes, would cover both *Mopsea* and *Clathraria*.

In the 'Challenger' Report the genus *Mopsea* is re-constructed, and if the definition there given be considered more satisfactory than Kölliker's, then it is necessary to continue to keep *Clathraria* apart from *Mopsea*. It is noted, for instance, as a characteristic of *Mopsea* that the branches arise mostly from the internodes, whereas in *Clathraria* they arise mostly from the nodes.

The spicules of *Mopsea* are described as “finely-spined, unsymmetrical scales, slightly notched at the edge ; the spicules of *Clathraria* are spiny and tuberculate clubs, warty double-clubs, and spindles with very minute warts.” For these and other reasons we think that *Clathraria* may be usefully retained as a distinct genus.

PROVISIONAL LIST OF RED SEA ALCYONARIANS.

Those included in Mr. Crossland’s collection are marked with an asterisk. The names in *square* brackets indicate the authorities for occurrence in the Red Sea. In other cases the authority for the species is also the authority for its occurrence in the Red Sea.

Order I. STOLONIFERA.

- \* *Clavularia pulchra*, Thomson & Henderson.
- Clavularia strumosa*, Ehrenberg.
- Clavularia glauca* (Savigny).
- \* *Sympodium fulvum*, Forskål [Klunzinger] [Kükenthal] = (according to Kükenthal) *Alcyonium fulvum* (Forsk.).
- Sympodium cæruleum*, Ehrenberg. [Klunzinger] [Kükenthal].
- Anthelia uliginosa* (Ehrb.)  $\left\{ \begin{array}{l} \textit{Sympodium fuliginosum}, \textit{Ehrenberg} \\ \textit{Sympodium purpurascens}, \textit{Ehrenberg} \\ \textit{Anthelia glauca} \textit{ (Ehrb.)} \textit{ [Klunzinger].} \\ \textit{Anthelia strumosa} \textit{ (Ehrb.)} \textit{ [Klunzinger].} \end{array} \right.$  [Klunzinger].
- [Kükenthal] = (according to Kükenthal) :
- \* *Tubipora purpurea*, Pallas [Klunzinger].
- Tubipora hemprichi*, Ehrenberg [Klunzinger].

Order II. ALCYONACEA.

- \* *Xenia umbellata*, Savigny [Klunzinger] [Kükenthal].
- \* *Xenia fuscescens*, Ehrenberg [Klunzinger] [Kükenthal].
- \* *Xenia cærulea*, Ehrenberg [Klunzinger].
- Xenia blumi*, Schenk [May].
- \* *Alcyonium sphaerophorum*, Ehrenberg [Klunzinger].
- Alcyonium globuliferum*, Klunzinger.
- Alcyonium digitulatum*, Klunzinger.
- Alcyonium pachyclados*, Klunzinger.
- Alcyonium brachyclados*, Klunzinger.
- Alcyonium polydactylum*, Dana [Klunzinger].
- Alcyonium leptoclados* [Klunzinger].
- Alcyonium gyrosum*, Klunzinger.

- Aleyonium pauciflorum*, Ehrenberg.  
*Aleyonium polydactylum*, Ehrenberg.  
*Aleyonium rubiformis*, Ehrenberg.  
*Aleyonium aurum*, Gray.  
*Aleyonium elegantissimum*, May.  
 \**Sarcophytum glaucum*, Quoy & Gaimard.  
*Sarcophytum pulmo*, Haeckel [Klunzinger].  
*Sarcophytum pauciflorum* [Klunzinger].  
*Sarcophytum savignyi*, Klunzinger.  
*Sarcophytum ehrenbergi*, Marenzeller.  
*Sarcophytum trocheliophorum*, Marenzeller.  
 \**Sclerophytum gardineri*, Pratt.  
 \**Sclerophytum querciforme*, Pratt.  
 \**Sclerophytum densum* (Whitelegge).  
*Lobophytum pauciflorum*, Ehrenberg.  
 \**Nephtya zanzibarensis*, Thomson & Henderson.  
 \**Nephtya albida* (Holm).  
*Nephtya chabrolii*, Milne-Edwards & Haime [Klunzinger].  
 \**Lithophytum thyrsoides*, (Kükenthal) = *Ammothea thyrsoides*, Ehrenberg  
 [Klunzinger].  
 \**Lithophytum arboreum*, Forskål [Klunzinger].  
 \**Lithophytum brassicum* (May).  
 \**Lithophytum crosslandi*, n. sp.  
 \**Lithophytum macrospiculatum*, n. sp.  
 \**Spongodes* † *hemprichi*, Klunzinger [Klunzinger] [Kükenthal].  
 \**Spongodes hartmeyeri*, Kükenthal [Kükenthal].  
 \**Spongodes suesiana*, n. sp.  
 \**Spongodes pharonis*, n. sp.  
*Spongodes savignyi*, Ehrenberg (Klunzinger) [Kükenthal].  
*Spongodes ramulosa*, Gray [Klunzinger].  
*Spongodes klunzingeri*, Studer [Kükenthal].  
*Spongodes arborea*, May [Kükenthal].  
*Spongodes mayi*, Kükenthal.  
*Spongodes ehrenbergi*, Kükenthal.

### Order III. PSEUDAXONIA.

- \**Melitodes coccinea* (Ellis) = *Isis coccinea*, Ellis.  
 \**Melitodes splendens*, n. sp.

† According to Prof. Kükenthal, who has revised this genus, the old name *Spongodes* should be changed to *Dendronephthya*. To us this appears neither necessary nor desirable.



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3.



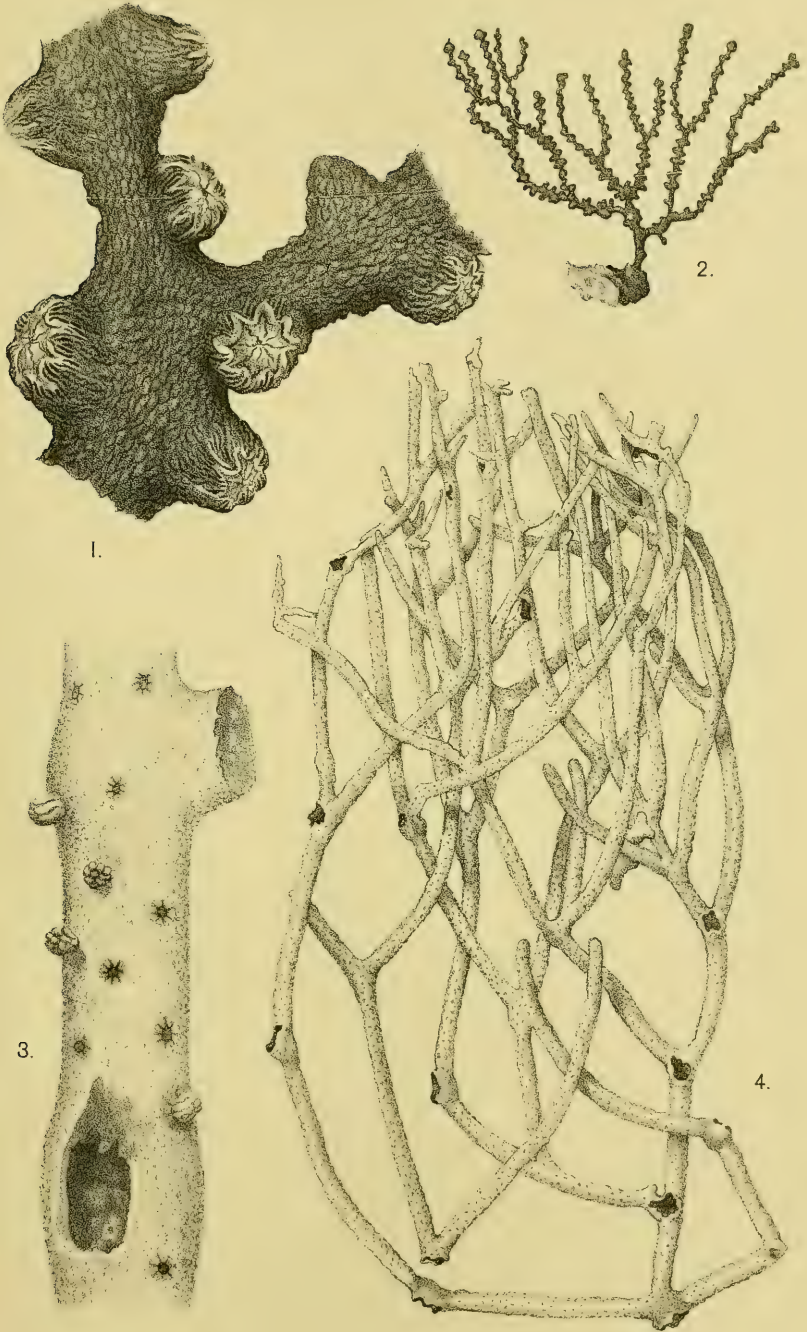
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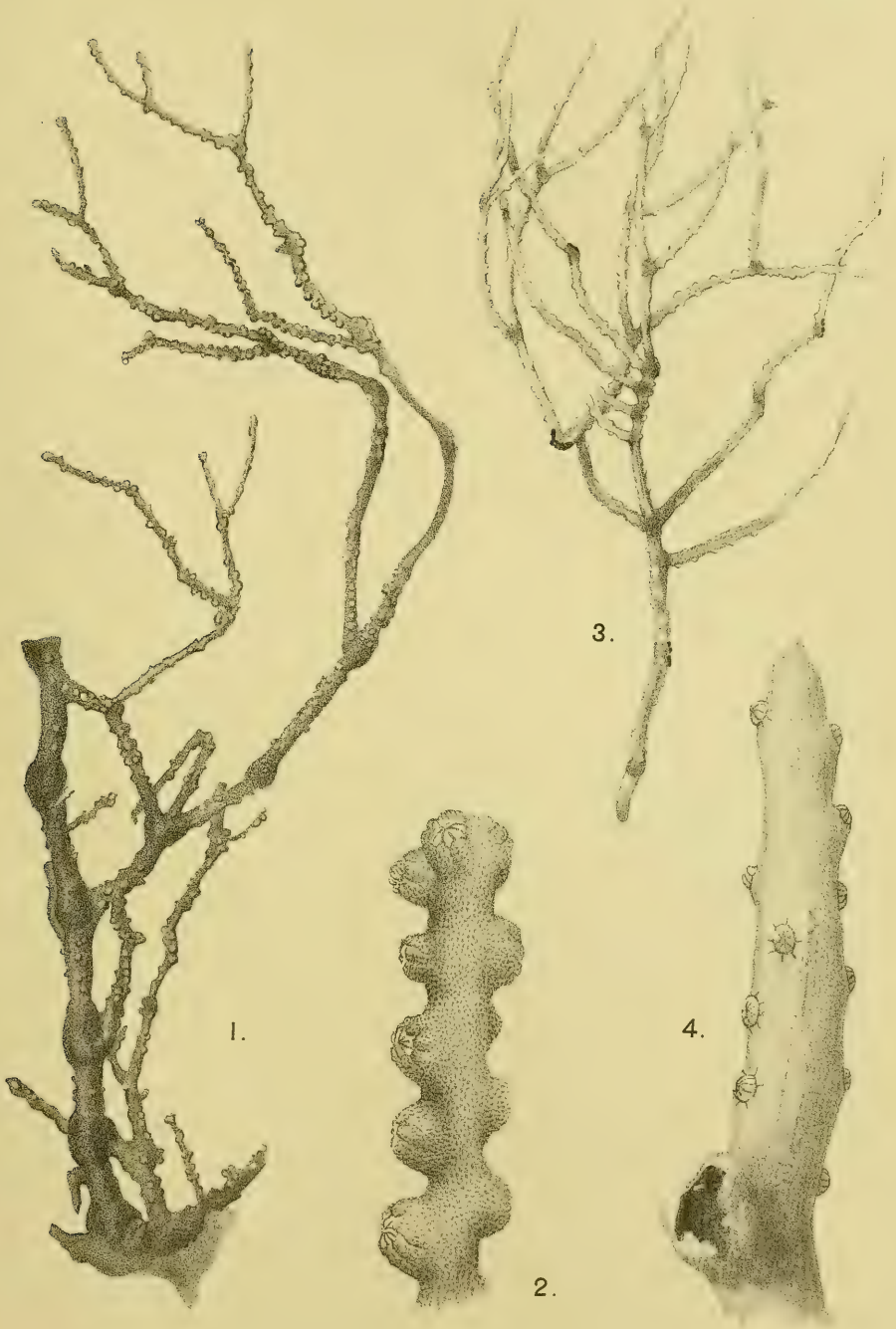
E. Wilson, lith & imp.

SUDANESE ALCYONARIA.

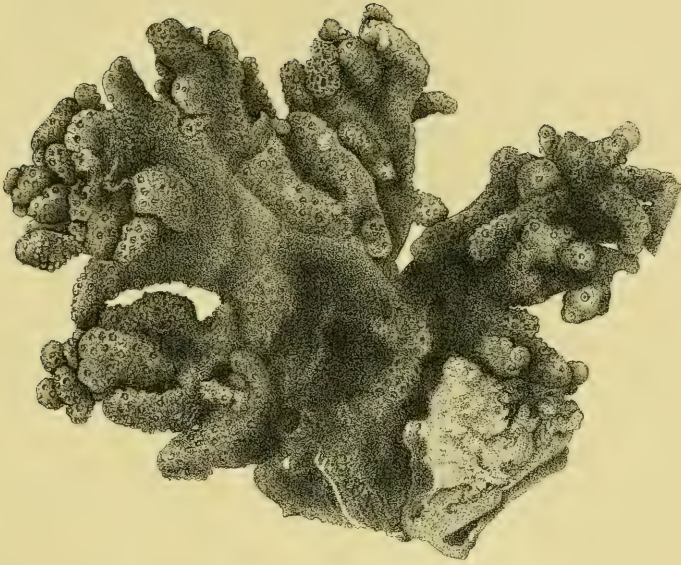


E. Wilson, lith. & imp.

SUDANESE ALCYONARIA.



E. Wilson, lith. & imp.



1.



2.



3.

E. Wilson, lith. & imp.

- Mopsella erythracea*, Gray [Klunzinger = *Mopsea erythræa*].  
 \* *Clathraria rubrinodis*, Gray.  
 \* *Clathraria acuta*, Gray.  
*Siphonogorgia mirabilis*, Klunzinger,

Order IV. **AXIFERA.**

- Caligorgia verticillata*.  
*Plexaura antipathes*, Kölliker [Klunzinger].  
*Plexaura torta*, Klunzinger.  
*Verrucella flexuosa* (Lamarck) [Klunzinger].  
*Juncella gemmacea*, Kölliker [Gray] [Klunzinger].  
*Juncella hepatica*, Klunzinger.

EXPLANATION OF THE PLATES.

PLATE 5.

- Fig. 1. *Spongodes suesiana*, n. sp. Nat. size.  
 2. *Spongodes pharonis*, n. sp. A small bundle of polyps.  $\times 10$ .  
 3. *Spongodes pharonis*, n. sp. Nat. size.  
 4. *Lithophytum brassicum* (Kükenthal). Nat. size.  
 5. *Sarcophytum glaucum*, Quoy & Gaimard. Nat. size.

PLATE 6.

- Fig. 1. *Melitodes coccinea* (Ellis).  $\times 12$ .  
 2. *Melitodes coccinea* (Ellis). Nat. size.  
 3. *Clathraria rubrinodis*, Gray.  $\times 7$ .  
 4. *Clathraria rubrinodis*, Gray. Nat. size.

PLATE 7.

- Fig. 1. *Melitodes splendens*, n. sp.  $\times 12$ .  
 2. *Melitodes splendens*, n. sp.  $\times 12$ .  
 3. *Clathraria acuta*, Gray. Nat. size.  
 4. *Clathraria acuta*, Gray.  $\times 7$ .

PLATE 8.

- Fig. 1. *Sclerophytum querciforme*, Pratt. Nat. size.  
 2. *Lithophytum macrospiculatum*, n. sp.  $\times 2$ .  
 3. *Lithophytum macrospiculatum*, n. sp. A cluster of polyps.  $\times 14$ .